HYDROLOGIC & ENGINEERING REPORT OF THE UPPER LONG VALLEY PROJECT CALIFORNIA/ NEVADA

WRD WATER RESEARCH & DEVELOPMENT, INC.

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Prepared For:

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I. EXECUTIVE SUMMARY

The Upper Long Valley Water and Land Management Project (Project) proposes to develop about 3,300 acre feet per year (AFY) of ground water in the Upper Long Valley for export into Cold Springs Valley and Lemmon Valley in Washoe County, Nevada. The Upper Long Valley is that portion of Long Valley, bounded on the south by Peavine Mountain and on the north by Hallelujah Junction (Highway 70). A two and one half mile well field and associated transmission (pipeline) easement has been established along Long Valley Creek and Highway 395 in Sierra and Lassen Counties, California. The southern portion of the well field is located about two (2) miles north of Bordertown, Nevada. Bordertown, itself is located about sixteen miles north of Reno, Nevada via Highway 395. See vicinity map (Map 1.) showing general location of the proposed Project and Map 3 showing the Project facilities.

The Project proposes to convey this water into Cold Springs Valley and Lemmon Valley to meet the existing quasi municipal demands in these areas. The terminus of the transmission system is at the Stead storage tank and Sierra Pacific Power Company pipeline system in Lemmon Valley. See Map 3 for proposed location and routing of the Project's transmission system. The intended use of this water is to meet the existing demand of these Valleys as set forth in Washoe County's Land Use Plan and zoning for Cold Springs Valley and Lemmon Valley, including Golden Valley. The intended use of this proposed water supply is not to promote additional growth in these Valleys, but to meet the current demand and to supplement the current (individual ground water wells) water supply in Golden Valley where the ground water aquifers have been contaminated from associated individual septic systems. The Project water supply meets and exceeds the standards established for a public water supply as set in the Safe Water Drinking Act.

A permanent ground water supply of good quality has been demonstrated to exist within the proposed well field of the Project. Two production wells, already constructed in the well field have been tested at production rates of 500 to 1200 gallons per minute. Hydrologically, the proposed pumpage of 3300 AFY is conservative since this rate represents only about 21 to 31 percent of the annual perennial yield or recharge of the Upper Long Valley. (Todd, 1989 & Water Research & Development, 1989) An extensive surface and ground water study (Water Research & Development, 1989), sponsored by the Project, further demonstrated that a firm ground water supply can be developed in the Upper Long Valley without adversely impacting either current or future water users in California.

The Project proposes to develop the Green Gulch Ranch, (Ranch) into a 1170 acre recharge facility to augment the natural recharge of the well field and to capture surplus spring runoff from tributary streams that may also be recharged into the well field aquifers. This Ranch's adjudicated water rights of about 794 acres, representing about

46 percent of the Upper Long Valley tributary water rights, may also be used to augment the proposed Project's ground water supply.

The Project intends to work cooperatively with the Upper Long Valley Ground Water Management District (District), the California Department of Fish and Game (CDFG), the Counties of origin (Sierra & Lassen) and other regulatory agencies concerned with the natural resources of this area. Additionally, the Project will communicate with individual concerned surface adjudicated water users of Long Valley Creek as well as ground water users in an effort to gain an appreciation of concerns and develop solutions to potential conflicts.

In conclusion, a permanent ground water supply has been demonstrated to exist in the Upper Long Valley to support this proposed Project. This has been proven by both an extensive hydrologic study, as well as actual well development and aquifer testing. The water supply is also of good quality, meeting and exceeding those standards for a public water supply as set forth by the Safe Water Drinking Act. If required, a recharge program is planned on the Ranch to further add to the ground water supply and to mitigate any potential concerns. By following this conservative approach and upon communication with California interests in Long Valley, we are optimistic that the environmental and permitting process required for the export of this ground water will be achieved.

The capital costs for the proposed "export" portion of the Project (wells, pumps, pipelines etc.) is approximated at $4.66 million, while the capital costs of the "water rights and mitigation" (easements, recharge land, environmental assessment, permitting etc.) portion of the Project is estimated at $8.70 million. The total capital cost of this proposed project to export 3,300 AFY from California to Nevada is therefore about $13.36 million or $4,050 per acre foot.

The operation and maintenance costs of the Project are estimated at $508,642 per year or about $154 per acre foot per year.

II. HYDROLOGY OF LONG VALLEY

Surface Water: Long Valley is situated in California and Nevada, headwatering in the south by Peavine Mountain and to the west by the Bald and Diamond Mountains and extends to the north some 40 miles, terminating in the Honey Lake playa. See Map 2. showing the general extent of this watershed. The primary source of water for the Valley is supplied by tributary streams located on the western side of the Valley. The surface waters of the entire Long Valley Creek and tributaries were adjudicated in 1976 by the Superior Court for Lassen County (California State Water Resources Control Board, 1976) .

For purposes of adjudicating and managing the lengthy Long Valley Creek system, the adjudication has separated different reaches of the Creek into individual Sections. See Map 2, showing the location of these Sections. The Upper Long Valley Section is that reach encompassing the headwaters of Long Valley Creek on the south at Peavine Mountain and tributaries (Purdy Creek, Balls Creek, etc.) continuing to the north to Hallelujah Junction (Highway 70). This is the Section in which the Project well field and the Ranch is located. The Canyon Section is that reach of the Creek from Hallelujah Junction to the "narrows". The Long Valley Section is that reach from the "narrows" to a point near Doyle, California and the terminus Section is the Honey Lake Section and defined as that reach from Doyle to Honey Lake, itself. Note: Honey Lake, a shallow ephemeral lake, does not hold an adjudicated water right from Long Valley Creek.

During the early spring (March, April & May) high runoff periods, the tributaries contribute high flows to Long Valley Creek, thereby meeting and exceeding Long Valley Creek adjudicated water rights in all Sections, including the Long Valley Section and Honey Lake Sections, located below the "narrows". During this period, excepting drought years, a surplus amount of water is discharged into the phreatophytic and playa areas of Honey Lake. Later in the season, beginning in June, the tributary creeks constitute the primary water supply for each Section and very little of this supply flows from Section to Section via Long Valley Creek. Since these Sections are supplied by independent tributary streams, the Adjudication recognized this hydrologic fact and treats the Sections in an autonomous manner when the runoff decreases in the late spring, summer and fall periods.

In the Upper Long Valley section (headwater to Highway 70), the primary water supply, supplied by tributaries, irrigates approximates 1744 acres of which the Ranch has an irrigation right for about 794 acres or 46 percent of the total. The California Department of Fish and Game (CDFG) has purchased 404 acres of the tributary rights and 256 acres of Long Valley Creek rights. Together, the Ranch and CDFG, own a total of (794 + 404 + 256) 1454 acres of tributary rights and Long Valley Creek rights or about 73 percent of the total water rights in the Upper Long Valley Section.

Hydrological Final Report: The Evans Ranch, Inc. (ERI) has funded a hydrologic investigation of the Upper Long Valley Section in which the Ranch and the proposed well field is located. The investigation, entitled "**Water Resources of the upper Long Valley California & Nevada, Final Report**" was completed in 1989 (Water Research & Development, Inc, 1989). The investigation includes a surface and ground water study whereby the interaction of both systems were considered as well as the adjudication of Long Valley Creek.

Surplus Surface Water: Surface water considerations include the modeling of the water sheds of the Upper long Valley by the **Water Resources Evaluation of Non-point Silvicultural Sources (WRENSS)** method (EPA, 1980). According to this hydrologic runoff model, a mean annual surplus of about **8,700 acre feet per year (AFY)** occurs in

the Upper Long Valley. During dry years this amount is **zero (0),** while on maximum years, this amount approaches **40,000 acre feet per year.** These surplus amounts have taken into account all of the adjudicated irrigated acreage water rights demand in the entire Long Valley Creek system. The accuracy of this predictive runoff model has been calibrated and is in excellent agreement with measured streamflow data.

Green Gulch Ranch, (Ranch) has made surface water applications (29567, 29568 & 29569) with the California State Water Resources Control Board (Board) to capture a large portion of this early spring surplus by diversion into Ranch reservoirs, spreading over 1170 acres of Ranch land and subsequent infiltration into the ground water aquifers, lying beneath the Ranch. These applications are in "good standing" with the Board and await subsequent consideration for permitting.

In summary, the surface adjudicated tributary water rights of the Upper Long Valley, make up the primary water supply for the water righted acreage in this Section. The Ranch owns 46 percent of these rights. Additionally, based upon an extensive surface water modeling (WRENSS) study, about 8700 AFY of surplus early spring surface tributary water is available for appropriation. The Ranch has made application for this amount with the California State Water Resources Control Board and these application are in "good standing". These surplus waters as well as the Ranch's adjudicated rights are available to be used to recharge and augment the ground water aquifers of the Ranch and the proposed well field along Long Valley Creek. The Project, therefore, is in a good position to utilize surface waters to augment the ground water supply of the Valley.

Ground water: Currently, the groundwater resource in the Upper Long Valley Section has not been significantly developed, excepting about 600 acre feet per year that has been permitted by the Nevada State Engineer for quasi municipal purposes in around Bordertown. Ground water use in the Upper Long Valley Section, located in California is limited to scattered domestic use and does not constitute a significant usage. This usage is not expected to increase appreciably in Sierra County since according to the County's General Land Use Plan the development density is limited to 160 acres per dwelling.

Ground water investigations undertaken by the Project have included the drilling of 15 test/pilot bore holes in the Upper Long Valley spanning a reach along Long Valley Creek from the Ranch (Purdy, School House, South tributary Creeks) northward to Evans Creek, a tributary Creek, located downstream of the proposed Project well field. These bore holes have provided lithographic and water occurrence information on both the west and east side of Upper Long Valley. Additionally a geological investigation has been conducted to ascertain the structure (faulting, depth of alluvium, types of geologic deposits, etc.) of the Valley. Based upon these investigations, the Upper long Valley is underlain by a large aquifer system (Pliocene nonmarine Hallelujah Formation) occupying about 12,300 acres at depths up to 2,000 feet. This aquifer formation is bounded on the east by the Peterson Mountains and on the west by the buried Long

Valley Fault. The amount of water stored in the top 100 feet of saturated thickness of this aquifer system ranges from **180,000 to 300,000 acre feet.**

Five of the pilot/test holes were developed into 16 inch, gravel enveloped production wells. The production rate of these wells varied from several hundred gallon per minute (gpm) to over a thousand gallon per minute. Based upon constant discharge pumping tests, the transmissivity of the aquifer system ranges from 10,000 to 20,000 gallon per day per foot, the storage coefficient (S) of the confined aquifer was estimated at 7×10^{-4} and specific yield (Sy) of the unconfined aquifer ranges between 0.15 and 0.25. These transmissivities correspond to hydraulic conductivities of 2 to 5 feet per day.

According to two independent investigators (Water Research & Development, Inc., 1989 & Todd Engineering, 1989), the potential perennial recharge of the Upper Long Valley into the ground water system varies from **10,600 to 15,600 acre feet per year,** respectively. Currently, however, since the ground water aquifer system has not been developed by pumping, the aquifer system is full and therefore rejects this potential recharge and runs off into the Creek system.

Ground Water Quality: Based upon ground water sampling from the production wells, the water, having a total dissolved solids (TDS) of 160 to 186 parts per million, meets the public water supply standards as set forth by the Safe Water Drinking Act. See Laboratory Reports of standard water parameters for Well E-1 (PW-3) and Well (PW-4) in the Appendix. Note, for purposes of this report, the production wells E-1 and E-3 have been renamed PW-3 and PW-4.

Currently, the ground water system in the Long Valley Section of the Creek system is only partly developed and is therefore full and rejects the potential natural recharge for the watershed during all years excepting drought years. The estimated annual perennial potential recharge or yield of the Upper Long Valley Section approximates 10,600 to 15,600 AFY. The amount of water stored in the top 100 feet of saturated thickness of this Section's aquifer system ranges from 180,000 to 300,000 acre feet. This ground water supply is of good quality.

Proposed Ground Water Pumpage & Impacts

The Project proposes to pump 3,300 acre feet per year (AFY) from the production wells constructed and planned within the well field. By pumping these wells, natural recharge will be encouraged due to the lowering of the ground water levels in the vicinity of the well field. During the initial phase of this Project, the water demand will be met by a surplus that can be pumped to provide storage space for natural recharge that is lost due to runoff during all years excepting drought years. Currently, since the ground water system is not developed in the Upper Long Valley Section, this water appears in Long Valley Creek early in the season (March, April & May) as surface runoff and is discharged to phreatophytic areas in the Honey Lake Section and to the Honey Lake,

itself. During later phases of the Project, the pumpage of 3,300 AFY would be met by natural recharge as storage space becomes available. This pumpage (3,300 AFY) is considered conservative in respect to the potential recharge estimates of 10,600 to 15,600 AFY that could infiltrate to the ground water aquifers by natural means. The pumpage represents about 21 to 31 percent of the potential recharge.

Based upon the surplus surface water modeling (WRENSS) and the pumpage of 3,300 acre feet per year from the ground water reservoir in the Upper Long Valley Section, a ground water storage volume of 6,273 acre feet is required to meet this withdrawal. Under this pumping rate, an average of 5,391 acre feet per year will be wasted during years when the ground water reservoir is full. The ground water reservoir will be full 22 years of the 38 years modeled or 58 percent of the time.

The feasibility of developing 6,273 acre feet of storage within the Upper Long Valley appears excellent when considering the potential storage of the aquifer lying beneath Upper Long Valley is thirty times this amount or about 180,000 acre feet in the top 100 feet of unconfined saturated thickness. This change in storage of 6,273 acre feet corresponds to a regional water level decline of 2.0 to 3.4 feet in the unconfined aquifer. This decline represents a maximum amount which would occur only once in the 38 year WRENSS simulated time period.

Water level decline in other ground water wells in the Upper long Valley near the proposed well field are expected to be insignificant due to the spatial relationship of these wells in relation to the Project well field. The mean spacing of wells within the well field approximates 3,500 feet, while the nearest quasi municipal ground water wells are those located upgradient near Bordertown about two miles to the south in Nevada. Since lands to the west and east of the well field are largely owned and controlled by the Unites States Bureau of Land Management or the CDFG, little or no domestic, quasi municipal or irrigation wells are envisioned as being developed in these areas. To the north, the nearest concentration of ground water development in the Upper Long Valley is downgradient in the Hallelujah Junction area, located about four miles away.

Ground water quality impact of the proposed Project would improve the water quality supply of some portions of Lemmon Valley where the existing supplies are in a state of degradation due to the leachate from individual septic systems which are entering the shallow ground water aquifers from which individual domestic wells are supplied. The ground water quality of the Upper Long Valley is not expected to be adversely impacted due to the Project's pumpage.

Under the initial phase of the Project pumpage of 3,300 AFY from the ground water aquifer, would result in the capture a portion of the natural perennial ground water recharge that now is rejected and appears as high spring runoff. Under normal runoff years this runoff is discharged into phreatophytic areas in the Honey Lake Section of the Creek system and into the Honey Lake Playa, itself.

In order to pump 3,300 AFY, a storage amount of 6,273 acre feet in the ground water aquifer is required in order to provide a firm water supply during drought years. In view of the fact that about 180,000 to 300,000 acre feet of storage water exists in the top 100 feet of the saturated thickness, this storage amount (6,273 acre feet) is easily achieved. During drought years when this storage amount is used, the resulting regional water level in the Upper Long Valley Section would decline 2.0 to 3.4 feet. This decline represents a maximum and would only occur once in the 38 years modeled.

Since the proposed well field is relatively isolated from other ground water wells in the Valley, the draw down effects of the Project's production wells are not expected to be measurable in these distant wells.

Professional Review of Proposed Pumpage & Impacts

A technical review of the hydrological report prepared by the Project entitled: "**Water Resources of the Upper Long Valley California & Nevada Final Report**" (Water Research & Development, Inc., 1989) including the proposal of exporting 3,300 acre feet per year has been made by the California Department of Water Resources (DWR). In general the DWR review of this report was favorable and the proposal for development of 3,300 acre feet per year and export was termed "reasonable". Washoe County hydrologists have also reviewed this report and have reported that the hydrological estimates are reasonable and the proposal for export is conservative. (Note: Washoe County hydrologists monitored the 72 hour constant discharge pump tests made on PW-3 and PW-4) The Nevada State Engineer has also reviewed this Report and has reported no hydrologic and engineering inconsistencies. Todd Engineers has also reviewed the perennial yield estimates made in the Report and agree that they are conservative (low).

In conclusion, no surface adjudicated water rights or existing ground water rights within the Long Valley Creek system is expected to be adversely impacted by the proposed Project. Due to the conservative nature of the withdrawal of 3,300 AFY in comparison to the potential annual recharge amount of 10,600 to 15,600 AFY and a storage or "buffer" amount of 180,000 to 300,000 acre feet existing in the top 100 feet of the aquifer, no overdraft will occur.

To ensure that no potential adverse impacts will occur, due to this proposed pumpage, an artificial recharge project is proposed on the Ranch, whereby surplus spring runoff waters would be captured and infiltrated or recharged into the ground water aquifers to augment the natural recharge.

III. PROPOSED EXPORT PROJECT

General: The Project propose is to convey 3,300 AFY from a well field in California in the Upper Long Valley, near Bordertown into Cold Springs Valley and Lemmon Valley in Nevada to meet existing demands and improve water quality in certain areas. During the initial phase of the Project, ground water will be taken from surplus waters that are now in storage to provide storage space for natural recharge that is now lost during most years as runoff, since the aquifer is essentially full. During a later phase, the ground water pumpage would be supplied by natural recharge and/or artificial recharge on Green Gulch, General Partnership (Ranch) and associated creek channels, including Long Valley Creek.

Well Field: The proposed well field is located on the CDFG, formerly a 9,000 acre cattle ranch straddling the California/Nevada State Line north of Bordertown and extending to the north along Long Valley Creek. This land has been recently purchased by the CDFG from the Evans Ranch (ERI). ERI, however has retained the ground water rights and associated easements for developing a ground water supply on 3,300 acres of this land. The Green Gulch Ranch (Ranch) is currently negotiating to purchase these rights from ERI. The well field, located within this easement, is situated along the east side of Long Valley Creek, where production wells PW-1 is sited on the west side of Highway 395, between Long Valley Creek and the Highway and production wells PW-2, PW-3 and PW-4 are located on the eastern side of Highway 395. The spacing between wells varies from 6,000 feet to 3500 feet. The southernmost production well (PW-4) is sited about 2 miles north of the quasi municipal wells, located in Washoe County, Nevada, serving Bordertown and the Reno Park Water Company. The northern extent of the well field (PW-1) is located about one half mile from nearest domestic well and about four miles from a concentration of domestic wells located near Hallelujah Junction at State Highway 70.

Production Wells: The Project proposes to develop or pump about 3,300 acre feet per year from four wells, two located in Lassen County and two located in Sierra County, California. Total pumping capacity of the four wells is designed at 2500 gallons per minute (gpm), while the mean pumping rate is 2050 gpm. At a continuous pumping rate (24 hr. per day and 365 days per year) of about 2050 gpm, a total discharge of 3,300 acre feet per year (AFY) would result. Production wells PW-1 and PW-2 are sited in Lassen County, while PW-3 and PW-4 are located in Sierra County. See Map 3 showing the Project well field, production well locations, pipeline conveyance system, booster pumping plants and storage facilities. Production wells (PW-3 and PW-4) have been constructed and pump tested. PW-3 production rate is 500 gpm and PW-4 is 1200 gpm. These pumping rates have been based upon 72 hour constant discharge pumping tests conducted by the Project. Production wells PW-1 and PW-2, having a design capacity of 400 gpm for each well, have not been constructed, however a pilot/test hole has been drilled at the PW-1 well site, whereby the production well design has been completed. At the planned PW-2 well site, a pilot/test hole must be constructed upon which the production well specification shall be based.

The individual power requirements at PW-1, PW-2, PW-3 and PW-4 are 50, 50, 40 and 100 HP, respectively. Since production wells PW-1 and PW-2 have not been constructed, the power demand for these two wells are approximate and based upon pilot/test hole lithography and performance of other production wells in the area. The power demand for production wells PW-3 and PW-4 are firm however, since they are based upon 24 hour step drawdown and 72 hour constant discharge pumping tests. Detailed pump test data is presented in the "Water Resources of the Upper Long Valley California & Nevada, Final Report (Water Research & Development, Inc., 1989). Projected static water levels at PW-1 and PW-2 are in the 25 foot range, while the drawdown at 400 gpm may be about 150 feet. The static water levels in PW-3 and PW-4 are 107 and 73 feet, respectively. The drawdowns for these two wells (PW-3 & PW-4) are 100 and 150 feet when pumped at 500 gpm and 1200 gpm, respectively.

Conveyance Pipeline: The proposed conveyance system is composed of 7,000 feet of 8" poly vinyl chloride (PVC), C-900 buried pipeline manifolding PW-1 and PW-2 together into 6,000 feet of 10" PVC pipeline to production well PW-3. 3500 feet of 12" PVC pipeline then conveys the discharge of these three production wells to PW-4, where the pipeline is increased to a 44,800 foot 16" PVC pipeline that conveys the discharge into and through Cold Springs Valley to the storage tank in Lemmon Valley. The easement for about 20,000 feet (3.8 miles) of the pipeline, located within the well field and extending toward the south shall be located within the CDFG Project Easement, while the remaining 41,000 feet (7.8 miles) would be constructed within the Cal Trans and Nevada Dept. of Transportation easement along Highway 395. No routing is considered on United States Bureau of Land Management lands. See Map 3 and Profile Figure 1. of pipeline routing.

Pumping Plants: Four (4) deep turbine line shaft and motor driven ground water well pumps are designed for the four production wells. The total horsepower demand for the production wells, assuming all four wells are being pumped, approximates 244 HP. Additionally, two booster pumps at PW-3 and W-4 will require an additional 139 HP. This pumping demand in Lassen and Sierra Counties would be supplied by three phase 440/220 volt service provided by the Plumas Rural Electrical Cooperative from a 24.9 KV transmission line from Alturas, California. No line extension or transformer charges are applied to the Project.

The Dry Lake Summit booster plant, located at the Cold Springs Valley foot of Dry Lake Summit requires about 256 HP. This demand may be provided by Sierra Pacific Power Company via a 24.9 KV power line sited along the west side of Highway 395 that services the Bordertown area. A line extension charge to extend across Highway 395 to the pump site will be applied as well as a transformer charge.

Treatment: Chlorination treatment is proposed at each of the well heads of the respective production wells. No other treatment, other than chlorination is included in this proposal.

Capital Costs: While four ground water well are required for the Project, only two are shown in the capital cost in Table 1. Project Water Export Capital Costs, since two ground water wells (PW-3 & PW-4) have been earlier constructed and tested by ERI. The value of these wells is included in the "water right" costs as shown under Item 4. of Table 2. Project Mitigation Capital Costs.

The unit costs for construction of the wells, purchasing pumping equipment, pipelines, controls etc. are based upon current costs of materials and installation on similar projects under construction at this time. Engineering, administrative and Nevada permitting costs would approximate 15 percent of the Sub Total capital costs. Additionally a 20 percent contingency cost is included.

The capital costs of this Project for ground water wells, deep turbine well pumps, well head chlorination stations, short coupled turbine booster pumps, buried transmission pipelines, controls, engineering and contingency, are summarized in Table 1 and totals **$4,664,136.**

Operations & Maintenance Costs: The annual operation and maintenance (O&M) costs for the Project includes the power costs for operating the pumping plants in both California as well in Nevada. The Plumas Rural Electrical Cooperative power charges include a $3.19/HP per month demand charge and an energy rate charge of $0.0569/Kwhr. The Sierra Pacific Power Company power charges are assumed to approximate Schedule No. GS-3 for "Large Customers" whereby a $700/meter/month demand charge and an energy charge of $0.0426/Kwhr is applied. The estimated annual power costs for operating this Project approximates **$248,142.** Additionally, an annual O&M cost of the wells, pumping plant, disinfection and controls, estimated at 5 percent of the capital cost of these components, is $60,000. O&M on the pipeline, itself, estimated at 1 percent of the pipeline materials and installation capital cost, is $25,500. The total cost of operating the export portion of the Project, approximates **$333,642.** See Table 3. Project Operation and Maintenance Costs.

IV. PROPOSED MITIGATION MEASURES

Surplus Surface Water: Green Gulch Ranch (Ranch) in 1989 has made Applications 29567, 29568 and 29569 (Applications) to appropriate surplus waters from tributaries (North, Schoolhouse, Purdy, East Branch, Balls Creek and unnamed creeks) that traverse the Ranch and from which the Ranch has adjudicated water rights. In support of these Applications, maps and plans for the reservoirs, distribution and spreading works for the infiltration of these surplus water have been submitted to the California State Water Resources Board (Board). Total storage capacity of the six reservoirs approximates 200 acre feet and spreading area for recharging the surface water into the ground water aquifer approximates 1170 acres, all situated on the Ranch.

Recharge Facilities: The proposed recharge facilities are made up of a combination of direct infiltration from earthen reservoirs and conveyance structures and the existing contour irrigation ditch system that exists on the Ranch. Additionally infiltration or recharge will also occur through the on-Ranch tributary creek channels as well as within Long Valley Creek on the Ranch as well as below the Ranch and along that reach of the Creek that parallels the proposed well field. Both Ranch adjudicated water rights as well as surplus surface water may be infiltrated through these facilities.

Riparian Habitat Improvement: By constructing on-Ranch reservoirs and spreading water over the entire Ranch, the surplus spring runoff waters will be captured and distributed in such a manner as to enhance the creeks channel riparian areas of both those located on the Ranch as well as downstream on Long Valley Creek, itself. The development of the Ranch property to maximize the riparian and wildlife habitat is expected to be attained through cooperative efforts between the Ranch, the CA FG and/or other conservation agencies.

Ranch Property: The Ranch is prepared to dedicate the 2200 acre Ranch, appurtenant adjudicated surface water rights (793.5 acres), the surplus surface water Applications (29567, 29568 & 29569) and "overlying" ground water rights that are also appurtenant to the Ranch to the Project to serve as a "back up" recharge or supply mechanism for the proposed well field. These amounts of artificial recharge waters, brought about by improvements made on the Ranch, would be available to augment the natural recharge of the ground water aquifer.

Monitoring: In cooperation with the Long Valley Ground Water Management District (District), the Project would fund a surface and ground water monitoring program to monitor and manage the Project pumpage export and manage the recharge component of the Project. The monitoring program would consist of nine stream gauge stations, located on Long Valley Creek a several points and on major tributary streams at the mountain front. These stations would include the re-establishment of the gauge at Hallelujah Junction, formerly operated by the United States Geologic Survey. Four precipitation gauges are also proposed to be located in the upper western watersheds in the Upper Long Valley Section to assist in predicting the spring runoff. Ground water response to natural and artificial recharge and pumpage of the well field would be monitored via four piozometric stations where at each station the piezometric pressure would be measured within the shallow unconfined aquifer and the deeper confined aquifer. Two of these pieozometers stations would be sited above the well field and two below the well field. Additionally, observation well water levels would be taken at 20 wells that are located above and below the recharge area and the well field. These well levels would be taken on a quarterly basis. An annual budget would also be provided by the Project to operate, maintain, process data and report the annual findings of this monitoring program.

California Environmental Assessment & Permitting: Several environmental and permitting concerns must be addressed in order to establish a firm water supply for the

Project. Among the regulating and resource agencies that may become involved in the Project, the following agencies will be involved:

Long Valley Ground Water Management District: The Ranch is in the process of submitting an application for a Permit to export 3,330 acre feet of water per year from the Upper Long Valley into Washoe County to the Long Valley Ground Water Management District (District). The Project will work cooperatively with the District to obtain this Permit and develop a program whereby this proposed export can be made without adversely impacting existing and furture uses in Long Valley as well as to guarantee a firm water supply for the export Project. In this process a environmental assessment may be made by a third party environmental professional group to ascertain the environmental impact that this Project may have. The Project will also fund the District to conduct a surface and ground water monitoring program.

Sierra & Lassen County Planning: Sierra County, as per the County General Land Use Plan, prefers that the Upper Long Valley remain "recreational and rural" in nature, including the preservation of ranch and open riparian and wildlife areas. By dedicating the Green Gulch Ranch (Ranch) to a recharge facility and thereby enhancing the riparian nature of the tributary creeks and Long Valley Creek, the objectives of the County's Land Use Plan is complimented. While Lassen County's nearest development in and near Hallelujah Junction and is somewhat remote to the Project well field and Ranch recharge facility, the Project will cooperate with the planning entities of this County to assure that there are no conflicts. The planning agencies of both Counties have been contacted and are aware of the Project's proposal.

California Department of Fish and Game (CDFG): The California Fish and Game Department (CDFG) also supports the rural land use of the Sierra County portion of the Valley to maintain the "east west" deer migration path that transects the Upper Long Valley and across Highway 395. A three to four mile wide corridor, along Long Valley Creek allows access for the seasonal migration of mule deer from the mountains on the west (Bald and Diamond) to and from the Peterson Mountains on the east side of the Valley. At this time the CDFG have purchased about 6,600 acres of land, including the Evans Ranch, Inc. lying along and parallel to Long Valley Creek to preserve and establish this deer corridor. The Project intends to work cooperatively with the CDFG in developing this Project, whereby the objectives of Project and this agency are complimentary.

California State Water Resources Control Board: The Project shall work with the California Water Resources Control Board (Board) in developing the well field and recharge facility in such a manner as to not adversely impact the adjudicated water rights of Long Valley Creek. Additionally, the Project shall continue to work with the Board in gaining permits to divert and recharge surplus waters of the Upper Long Valley as per the Applications made by the Ranch.

California Department of Water Resources (DWR): The Project shall continue to work with DWR in developing the Project. The Long Valley Ground Water Management District (District) is expected to rely upon the DWR for expert and technical advise in respect to this Project. DWR has already reviewed the hydrological Final Report (WRD, 1989) and provided useful comments and suggestions. The Project intends to respond and further seek input from this agency in developing the Project.

Nevada State Engineer: The State Engineer has been periodically informed of the progress of this Project and has been provided a copy of the Final Report (Water Research & Development,1989) for staff review. It is recognized that an application for a permit to import this water supply must be made to the State Engineer, in seeking this Office's permission to provide this water supply as a permanent source for quasi municipal use in Washoe County.

Regional Water Commission: Through the Regional Water Commission and under the authorization of Nevada Senate Bill 49 and per other agreements between Washoe County and Sierra Pacific Power Company, this Project is now presented to this Commission for consideration. The Project expects to work closely with this Commission and the technical staff in developing this proposed Project.

Capital Costs: The estimated cost of acquisition of the Evans Ranch, Inc. (ERI) ground water wells (PW-3 & PW-4), the CDFG well field easement and development costs is estimated at **$1,000,000**, while the cost of the Green Gulch Ranch is approximated at **$2,000,000**. The 3,300 acre feet of water rights, valued at **$1,000** per acre foot, are estimated at **$3,300,000.**. The estimated costs for construction of six Ranch reservoirs, conveyance and distribution system, including control gates and diversion structures for the recharge of surplus surface waters is estimated at **$1,700,000.** The cost of the monitoring equipment, including installation is approximated at **$200,000** and the cost of funding a California Environmental assessment and permitting is estimated at **$500,000** (Summit Evirosolutions, 1996) The total capital cost for Project water and mitigation is therefore approximated at **$8,700,000.** See Table 2. Project Water & Mitigation Capital Costs.

Operations & Maintenance Costs: The O&M costs for the surface and ground water monitoring system is approximated at 10 percent of the capital cost or about **$20,000** and the cost to monitor the equipment, data processing and reporting is estimated at **$70,000.** The cost of maintaining and repairing the Ranch recharge system (reservoirs, conveyance & distribution) is estimated at 5 percent of the capital cost or about **$85,000.** The total O&M cost for Ranch mitigation is therefore **$175,000.** See Table 3. Project Operation and Maintenance Costs (Export & Mitigation).

REFERENCES

California State Water Resources Control Board, 1976 "Long Valley Creek Adjudication", Decree No. 12999, Long Valley Creek System within California in Counties of Lassen, Sierra and Plumas, 108 p.

Environmental Protection Agency, 1980 "An Approach to Water Resources Evaluation of Non-Point Silvicultural Sources (Procedural Handbook)". Chapter 3 - Hydrology by C.F. Leaf and C.A. Troendel.

Summit Envirosolutions, 1996 Personal communications with Ms. Colleen Bathker.

Todd, Kieth David Consulting Engineers, Inc. 1989 "Preliminary Review of Ground water resources for Part of the Upper Long Valley" 12 p. Prepared for Balls Canyon Ranch.

Water Research & Development, Inc. 1989 "Water Resources of the Upper Long Valley California & Nevada Final Report". 200 p. Prepared for Evans Ranch, Inc.

TABLE 1. PROJECT WATER EXPORT CAPITAL COSTS

Item	Quantity	Units	Description	Cost
1.	2	wells	16" x 700' ground water wells const. to quasi municipal regulations at $150,000/well	$300,000
2.	244	HP	Four (4) deep turbine line shaft , motor driven pump, panel, controls & enclosure at $500/HP	$122,000
3.	395	HP	Three(3) short coupled turbine in-line booster pumps, motor drivers, controls & enclosures at $300/HP	$118,500
4.	7,000	feet	8" Poly vinyl chloride, C-900 pipeline & buried installation at $2.92/IDF *	$163,520
5.	6,000	feet	10" poly vinyl chloride, C-900 pipeline & buried installation at $2.92/IDF	$175,200
6.	3,500	feet	12" Poly vinyl chloride, C-900 pipeline & buried installation at $2.92/IDF	$122,640
7.	44,800	feet	16" Poly vinyl chloride, C-900 pipeline & buried installation at $2.92/IDF	$2,093,056
8.	4	stations	Four (4) chlorination stations at each well head at $10,000/station	$40,000
9.	lump sum	$	Telemetry, hydraulic controls, pump sta. enclosures & power line/tranformer	$320,000
			SUB TOTAL	**$3,454,916**
10.	dollars	%	Engineering, Administrative & Permitting at 15% of capital cost Sub Total	$518,237
11.	dollars	%	Contingency at 20% of capital cost Sub Total	$690,983
			TOTAL	**$4,664,136**

Item 1. A total of four wells are required. Two wells (PW-3 & PW-4) have been constructed by the Project. All wells located in California.

Item 3. Two booster pumps, totaling 139 HP required a PW-3 and PW-4, all located within California. A 256 HP booster station shall be located in Nevada at the base of Dry Lake Summit.

Items 4., 5., 6. & 7. IDF = inch diameter foot. All of the 8", 10" and 12" pipeline length and 3696 feet of the 16" pipeline is sited within California.

TABLE 2. PROJECT WATER & MITIGATION CAPITAL COSTS

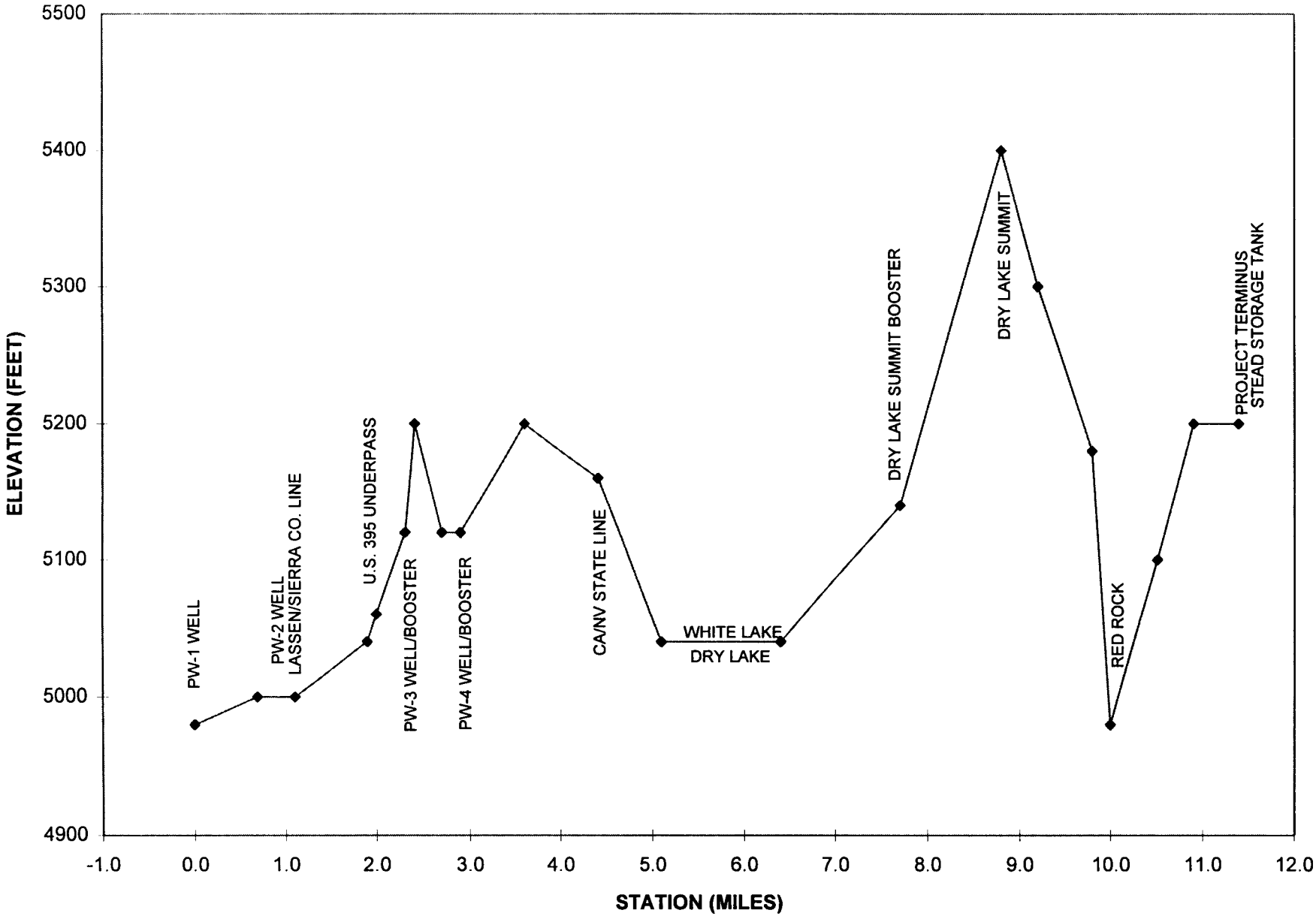
Item	Description	Cost
1.	Acquisition of Evans Ranch, Inc. Water rights, Wells (PW-3 & PW-4), Easements, Hydrological Investigations & Development costs	$1,000,000
2.	Green Gulch Ranch Properties	$2,000,000
3.	Water Rights, 3300 acre feet at $1000/acre foot	$3,300,000
	SUB TOTAL	**$6,300,000**
4.	Green Gulch Ranch Recharge System Improvements (reservoirs, conveyance, distribution & riparian areas)	$1,700,000
5.	Upper Long Valley Surface & Ground Water Monitoring (Site Work, Equipment & Installation)	$200,000
6.	Environmental Assessment & Permitting	$500,000
	SUB TOTAL	**$2,400,000**
	TOTAL	**$8,700,000**

TABLE 3. PROJECT OPERATION AND MAINTENANCE COSTS (EXPORT & MITIGATION)

Item	Description	Cost/Year
1.	California Power (279 KW) PW-1, PW-2, PW-3 & PW-4 deep well turbine pumps and PW-3B & PW-4B short coupled turbine booster pumps at $3.19/HP/mo. demand charge & $0.0569/KWhr by Plumas Rural Electical Cooperative	$153,727
2.	Nevada Power (191KW) for Dry Lake Summit short coupled turbine booster pump at $6.43/KW/Mo demand, $700/meter/Mo charge & $0.0426/KWhr by Sierra Pacific Power Company	$94,415
3.	Ground water well, pumping plants, disinfection, controls and repair at 5% of capital cost	$60,000
4.	Pipeline maintenance and repair at 1% of capital cost	$25,500
	SUB TOTAL	**$333,642**
5.	Monitoring equipment & instrument maintenance and repair at 10% of capital cost	$20,000
6.	Surface water and ground water monitoring, data processing & reporting	$70,000
7.	Green Gulch Ranch recharge facilities (reservoirs, conveyance, distribution & control) maintenance & repair at 5% of capital cost	$85,000
	SUB TOTAL	**$175,000**
	TOTAL	**$508,642**

** Total operation and maintenance does not include levies or fees that may be made by the Long Valley Ground Water Management District and/or the Counties (Sierra & Lassen) of origin.

FIGURE 1. UPPER LONG VALLEY WATER & LAND MANAGEMENT PROFILE



GRNPROF.XLS
7/24/96

WATER RESEARCH AND DEVELOPMENT

APPENDIX

Water Quality Analyses for PW-3 (E-1) & PW-4 (E-3)

CHEMAX LABORATORIES, INC.
EPA Lab ID #NV004
1420 Kleppe Lane
Sparks, Nevada 89431
P.O. Box 21122
Reno, Nevada 89515
702-355-0202

LABORATORY REPORT

Report To: Water Research & Development
P.O. Box 9066
Reno, NV 89507-9066

Lab Report No.: 3323
Account No.: WTRRD

Telephone: 747-1100

Work Authorized By: Clare Mahannah
Date Sampled: 12/1/88
Number of Samples: 1
Source: "E-1"
Chemax Control No. 88-4108

Date Submitted: 12/15/88
Sampled By: Client
Your Reference:

Notes: THIS LAB REPORT SUPERSEDES THE SAME REPORT ISSUED 12/29/88.

Parameter	Result
pH	8.48
Alkalinity, mg/L as CaCO3	100
Bicarbonate, mg/L	118
Carbonate, mg/L	2
Turbidity, NTU	0.40
Color, CU	0-5
Total Dissolved Solids, mg/L	160
Hardness, mg/L as CaCO3	47
Chloride, mg/L	<0.3
Sulfate, mg/L	6.1
Fluoride, mg/L	<0.1
Nitrate, mg/L as NO3	0.01
Arsenic, mg/L	0.0047
Calcium, mg/L	8.1
Magnesium, mg/L	5.5
Sodium, mg/L	22
Potassium, mg/L	7.7
Iron, mg/L	<0.25
Manganese, mg/L	0.044
Copper, mg/L	<0.025
Zinc, mg/L	0.078
Boron, mg/L	<0.5

Remarks: mg/L (milligrams per liter) = ppm (parts per million).

Analysis By: Faulstich/Schlang/Shen/Ziech Date: 12/29/88

Approved By: Date: 01/11/89

CHEMAX LABORATORIES, INC.
EPA Lab ID #NV004
1420 Kleppe Lane
Sparks, Nevada 89431
P.O. Box 21122
Reno, Nevada 89515
702-355-0202

LABORATORY REPORT

eport To: Water Research & Development
P.O. Box 9066
Reno, NV 89507-9066

Lab Report No.: 3361
Account No.: WTRRD

elephone: 747-1100

'ork Authorized By: Clare Mahannnah
ate Sampled: 12/19/88
Number of Samples: 1
Source: Evans Ranch Well E-3
hemax Control No. 88-4145
otes:

Date Submitted: 12/19/88
Sampled By: Client
Your Reference:

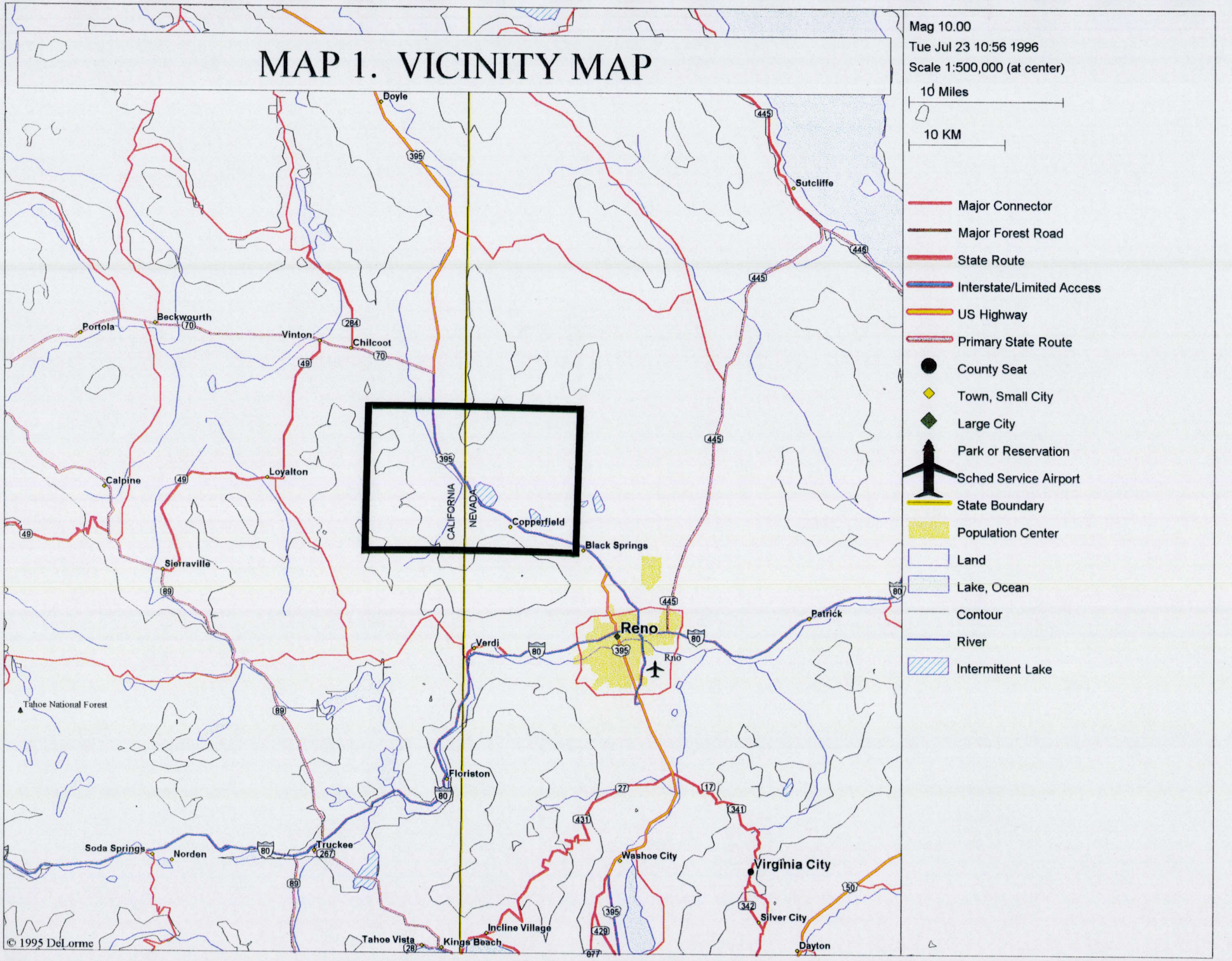
Parameter	Result
pH	8.55
Alkalinity, mg/L as CaCO3	100
Bicarbonate, mg/L	113
Carbonate, mg/L	5
Turbidity, NTU	0.40
Color, CU	5-10
Total Dissolved Solids, mg/L	186
Hardness, mg/L as CaCO3	47
Chloride, mg/L	0.13
Sulfate, mg/L	4.6
Fluoride, mg/L	0.059
Nitrate, mg/L as NO3	0.80
Arsenic, mg/L	0.0053
Calcium, mg/L	10
Magnesium, mg/L	4.7
Sodium, mg/L	22
Potassium, mg/L	7.3
Iron, mg/L	<0.05
Manganese, mg/L	<0.015
Copper, mg/L	<0.025
Zinc, mg/L	<0.05

Remarks: mg/L (milligrams per liter) = ppm (parts per million).

alysis By: Faulstich/Schlang/Shen/Ziech Date: 01/06/89

Approved By: Date: 01/06/89

MAP 1. VICINITY MAP



HONEY LAKE SECTION

LONG VALLEY SECTION

THE CANYON SECTION

UPPER LONG VALLEY SECTION

Honey Lake
To Herlong
To Susanville
HONEY LAKE SECTION
LONG VALLEY SECTION
THE CANYON SECTION
UPPER LONG VALLEY SECTION
R15E R16E R17E R18E
T26N T25N T24N T23N T22N T21N T20N
Long Valley Canyon
Downing Canyon
DOYLE
Willow Ranch Creek
Dry Creek Valley
McKissick Cr.
North Cr.
Malley
Malley South Cr.
Shaber Cr.
Rhodes Cr.
Horse Cr.
Zambolla Cr.
Whitehouse Cr.
TRESSEL HOT SPRINGS
HWY 395 USGS GAGE ("NARROWS")
RED ROCK
DIAMOND MOUNTAINS
WESTERN PACIFIC RR.
EMILY HOT SPRINGS
NEW USGS GAGE
HWY 70 USGS GAGE
HALLELUJAH JUNCTION
CALIFORNIA NEVADA
STATE OF
LASSEN COUNTY
SIERRA COUNTY
PETERSEN MOUNTAINS
BORDER TOWN
COLD SPRINGS
PLAYA
SITE #1
SITE #2
SITE #3
TH-6/PW-2
EVANS #1
BALD MOUNTAINS
HAVANNA
GRN. GUL.
Roberts Canyon
Dark Canyon
Balls Canyon
Purdy Creek
East Branch
South Fork
To Reno
PEAVINE MOUNTAIN
SCALE: 1" = 8000'
0 8000 16000 24000 32000
SCALE IN FEET

LEGEND

- STATE LINE
- TOWNSHIP & RANGE LINE
- SECTION LINE
- U.S. HIGHWAY
- INTERSTATE HIGHWAY
- RAILROAD
- WATERSHED BOUNDARY
- EVANS RANCH BOUNDARY
- PERENNIAL STREAMS & LAKES
- EPHEMERAL STREAMS
- 17 WRD STREAM FLOW LOCATION
- USGS STREAM FLOW GAGE
- TH-5 WELL LOCATION
- SPRING
- RING INFILTROMETER SITE

MAP 2

UPPER LONG VALLEY, THE CANYON, LONG VALLEY & HONEY LAKE SECTIONS

WITH WELLS, STREAMFLOW & INFILTRATION MEASUREMENT LOCATIONS

WRD WATER RESEARCH & DEVELOPMENT, INC.
P. O. BOX 9066 • RENO, NV 89507-9066 • (702) 747-1100 • FAX: (702) 747-1228

MAP 2

MAP 3

UPPER LONG VALLEY WATER & LAND MANAGEMENT PROJECT CALIFORNIA & NEVADA

PREPARED FOR:
GREEN GULCH RANCH

NORTH

SCALE: 1" = 2000'
1:24,000

CONTOUR INTERVAL: 200'

LEGEND:

- FREEWAY
- PAVED STREET
- DIRT ROAD
- SECTION LINE
- CONTOUR LINE
- LAKE / LAKEBED
- CREEK
- WELL / BOOSTER PUMP
- PIPELINE
- CA DEPT. OF FISH & GAME
- EVANS RANCH & ASSOCIATES
- GREEN GULCH RANCH

WATER RESEARCH & DEVELOPMENT, INC.
P.O. BOX 9066
RENO, NV 89507

(702) 747-1100

DRAWN BY: CCM

CHECKED BY: CNM

DATE: 7/22/96

JOB: 96-42
FILE: \ACAD12\WRD\GRNGUL.DWG

SHEET 1 OF 1